

REMARKS

Claims 1, 6, 11, 16 and 18 are amended. Claims 4, 5, 9 and 10 are cancelled. Claims 1-3, 6-8, 11-22 and 24-31 are pending in the application.

Independent claims 1 and 6 and their corresponding dependent claims stand rejected under 35 U.S.C. § 103(a) as being unpatentable over various cited combinations of Stauf, U.S. Patent No. 6,277,436; DiMeo, U.S. Patent No. 5,972,430; Senzaki, U.S. Patent No. 6,238,734; and Kang, U.S. Patent No. 6,127,218. The Examiner is reminded by direction to MPEP § 2143 that a proper obviousness rejection has the following three requirements: 1) there must be some suggestion or motivation to modify or combine reference teachings; 2) there must be a reasonable expectation of success; and 3) the combined references must teach or suggest all of the claim limitations. Pending claims 1-3, 6-8 and 25-28 are allowable over Stauf, DiMeo, Kang and Senzaki for at least the reason that the references, individually or as combined, fail to disclose or suggest each and every limitation in any of those claims.

As amended, independent claim 1 recites a method of forming a barium strontium titanate (BST) dielectric layer by simultaneously flowing at least one metal organic precursor, gaseous titanium and at least one gaseous oxidizer comprising H₂O, the dielectric layer being non-homogenous with respect to a ratio of barium relative to strontium within the layer. The amendment to claim 1 is supported by the specification at, for example, page 8, line 21 through page 9, line 7. As indicated by the Examiner at pages 3 and 5 of the present action, Stauf, DiMeo and Senzaki fail to disclose or suggest a non-homogenous BST layer. Kang discloses utilization of two different oxidants during a dual deposition technique to form a dielectric layer such as BST (col. 2, ll. 50 through col. 3, ll.

4). Kang additionally discloses that the resulting film has differing ratios of strontium relative to titanium (col. 5, ll. 1-32). In combination, the layer comprising varied strontium to titanate ratios disclosed by Kang, and the Senzaki, Stauf and DiMeo disclosures which do not teach or suggest the recited non-homogenous BST layer, fail to suggest the claim 1 recited method of forming a BST layer which is non-homogenous with respect to an amount of barium relative to strontium. Accordingly, independent claim 1 is not rendered obvious by the various cited combinations of Kang, Senzaki, Stauf and DiMeo and is allowable over these references.

Dependent claims 4 and 5 are cancelled. Dependent claims 2-3 and 25-26 are allowable over the various cited combinations of Kang, Senzaki, Stauf and DiMeo for at least the reason that they depend from allowable base claim 1.

As amended, independent claim 6 recites a method of forming a BST layer where the layer has a first portion having a first ratio of barium relative to strontium, and a second portion having a second ratio of barium relative to strontium, the first ratio differing from the second ratio. Independent claim 6 is allowable over the various cited combinations of Senzaki, Stauf, Kang and DiMeo for at least reasons similar to those discussed above with respect to independent claim 1.

Dependent claims 9 and 10 are cancelled. Dependent claims 7-8 and 27-28 are allowable over Kang, Senzaki, Stauf and DiMeo for at least the reason that they depend from allowable base claim 6.

Claims 11-24 and 29-31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over various cited combinations of Stauf, Senzaki and DiMeo. As amended, independent claim 11 recites a method of forming a BST dielectric layer by simultaneously

flowing at least one metal organic precursor, gaseous titanate and an oxidizer comprising water and at least one other oxidizer. Claim 11 further recites that an amount of titanate incorporated into the dielectric layer differs from an amount that would be incorporated in the absence of the H₂O. The amendment to claim 11 is supported by the specification at, for example, page 10, line 13 through page 11, line 4. Neither Stauf nor Senzaki disclose or suggest the claim 11 recited oxidizer comprising water. DiMeo discloses various oxidizers including water (col. 9, ll. 1-4) however, DiMeo does not disclose or suggest the claim 11 recited deposition method utilizing an oxidizer comprising water to affect titanate incorporation. The Stauf and Senzaki disclosures which fail to teach or suggest the recited oxidant comprising water, combined with the mention of water as a potential oxidizer in DiMeo does not suggest the claim 11 recited affecting an amount of titanate incorporated into a dielectric layer using an oxidizer comprising water during layer deposition. Accordingly, independent claim 11 is not rendered obvious by the cited combinations of Stauf, Senzaki and DiMeo and is allowable over these references.

Dependent claim 16 is amended to properly depend from independent claim 11. Dependent claims 12-17 and 29-30 are allowable over the cited combination of Stauf, Senzaki and DiMeo for at least the reason that they depend from allowable base claim 11.

As amended, independent claim 18 recites influencing an amount of titanium incorporated into a dielectric layer utilizing H₂O₂ during deposition of the layer. Independent claim 18 is allowable over the cited combinations of Stauf, Senzaki and DiMeo for at least reasons similar to those discussed above with respect to independent claim 11.

Dependent claims 19-22 and 31 are allowable over Stauf, Senzaki and DiMeo for at

least the reason that they depend from allowable base claim 18.

For the reasons discussed above, pending claims 1-3, 6-8, 11-22 and 24-31 are allowable. Accordingly, applicant respectfully requests formal allowance of such pending claims in the Examiner's next action.

Respectfully submitted,

Dated: May 28, 2003

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Appl. No. 09/905,286

Application Serial No. 09/905,286
Filing Date July 13, 2001
Inventor Cem Basceri et al.
Assignee Micron Technology, Inc.
Group Art Unit 1762
Examiner Fuller, Eric B.
Attorney's Docket No. MI22-1724
Title: Chemical Vapor Deposition Methods of Forming Barium Strontium Titanate
Comprising Dielectric Layers

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JUN 03 2003
TC 1700

VERSION WITH MARKINGS TO SHOW CHANGES MADE ACCOMPANYING
RESPONSE TO JANUARY 29, 2003 FINAL OFFICE ACTION

In the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

1. (Amended) A chemical vapor deposition method of forming a barium strontium titanate comprising dielectric layer, comprising:
positioning a substrate within a chemical vapor deposition reactor; and
simultaneously a) providing gaseous barium and strontium within the reactor by flowing at least one metal organic precursor to the reactor, b) providing gaseous titanium within the reactor, and c) flowing at least one gaseous oxidizer comprising H₂O to the reactor under conditions effective to deposit a barium strontium titanate comprising dielectric layer on the substrate, the a ratio of barium relative to strontium within the dielectric layer being non-homogenous oxidizer comprising H₂O.

6. (Amended) A chemical vapor deposition method of forming a barium strontium titanate comprising dielectric layer, comprising:

positioning a substrate within a chemical vapor deposition reactor; and

simultaneously a) providing gaseous barium and strontium within the reactor by flowing at least one metal organic precursor to the reactor, b) providing gaseous titanium within the reactor, and c) flowing at least one gaseous oxidizer comprising H_2O_2 to the reactor under conditions effective to deposit a barium strontium titanate comprising dielectric layer on the substrate, the dielectric layer having a first portion comprising a first ratio of barium relative to strontium, and a second portion having a second ratio of barium relative to strontium, the first ratio differing from the second ratio ~~oxidizer comprising H_2O_2~~ .

11. (Amended) A chemical vapor deposition method of forming a barium strontium titanate comprising dielectric layer, comprising:

positioning a substrate within a chemical vapor deposition reactor; and

simultaneously a) providing gaseous barium and strontium within the reactor by flowing at least one metal organic precursor to the reactor, b) providing gaseous titanium within the reactor, and c) flowing gaseous oxidizers to the reactor under conditions effective to deposit a barium strontium titanate comprising dielectric layer on the substrate, the oxidizers comprising at least H_2O and at least another oxidizer selected from the group consisting of O_2 , O_3 , NO_x , and N_2O , and H_2O_2 , where "x" is at least 1, an amount of titanate incorporated into the dielectric layer differing from an amount that would be incorporated in the absence of the H_2O under otherwise identical conditions.

16. (Amended) The method of claim 11 wherein the ~~another oxidizer comprises~~
oxidizers further comprise H_2O_2 .

18. (Amended) A chemical vapor deposition method of forming a barium
strontium titanate comprising dielectric layer, comprising:

positioning a substrate within a chemical vapor deposition reactor; and

simultaneously a) providing gaseous barium and strontium within the reactor by
flowing at least one metal organic precursor to the reactor, one or more of the at least one
metal organic precursors comprising a β -diketonate ligand selected from the group
consisting of thd, methd, and dmp, b) providing gaseous titanium within the reactor, and
c) flowing gaseous oxidizers to the reactor under conditions effective to deposit a barium
strontium titanate comprising dielectric layer on the substrate, the oxidizers comprising at
least H_2O_2 and at least another oxidizer selected from the group consisting of O_2 , O_3 , NO_x ,
and N_2O , where "x" is at least 1, wherein the presence of H_2O_2 during deposition of the
dielectric layer influences the amount of Ti incorporated into the dielectric layer.

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